

**Teamwork and Communication**

# Medical Team Training: Applying Crew Resource Management in the Veterans Health Administration

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**C**ommunication failure is a leading source of adverse events in health care. Gawande et al.<sup>1</sup> cited communication breakdowns as contributing factors in 43% of adverse events in surgical cases. Risser and colleagues<sup>2</sup> found a significant number of teamwork failures in review of malpractice claims for care in emergency rooms. Sutcliffe, Lewton, and Rosenthal<sup>3</sup> reported communication failure as one of the most commonly cited contributing factors in 70 patient care adverse events in a university teaching hospital. The Joint Commission has identified communication failure as a pivotal factor in more than 65% of sentinel event reports since 1995.<sup>4</sup>

Several large studies of intensive care units (ICU) have demonstrated that higher levels of coordination and more effective communication among staff members improved the efficiency of care, reduced risk-adjusted morbidity and mortality, or increased job retention among nurses.<sup>5-7</sup> Pronovost et al.<sup>8</sup> showed that implementing a daily goals form improved care coordination and reduced length of stay in the ICU. In an observational study of cardiac surgical teams performing the arterial switch procedure in newborn infants, Carthey et al.<sup>9</sup> reported that more favorable patient outcomes were associated with effective collaborative teamwork in the operating room (OR).

Traditional training and education of physicians, nurses, and allied health personnel has focused on individual technical skills for proficiency of specific tasks. Little

## Article-at-a-Glance

**Background:** Communication failure, a leading source of adverse events in health care, was involved in approximately 75% of more than 7,000 root cause analysis reports to the Department of Veterans Affairs (VA) National Center for Patient Safety (NCPS).

**Methods:** The VA NCPS Medical Team Training (MTT) program, which is based on aviation principles of crew resource management (CRM), is intended to improve outcomes of patient care by enhancing communication between health care professionals. Unique features of MTT include a full-day interactive learning session (facilitated entirely by clinical peers in a health care context), administration of pre-and postintervention safety attitudes questionnaires, and follow-up semistructured interviews with reports of program activities and lessons learned.

**Results:** Examples of projects in these facilities include intensive care unit (ICU) teams' patient-centered multidisciplinary rounds, surgical teams' preoperative briefings and debriefings, an entire operating room (OR) unit's adoption of "Rules of Conduct" for expected staff behavior, and an ICU team's use of the model for daily administrative briefings.

**Discussion:** An MTT program based on applied CRM principles was successfully developed and implemented in 43 VA medical centers from September 2003 to May 2007.

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attention has been given to how professionals work together in the complex and dynamic world of health care. To address this issue, the Institute of Medicine has recommended the application of crew resource management (CRM) training in health systems.<sup>10</sup>

### CRM

What is CRM and how is it relevant to health care? From several workshops in 1979 and 1980, the aviation industry concluded that failures of collaborative interaction and teamwork were responsible for 70% of airline crashes examined.<sup>11</sup> In response to these findings, airline companies began developing training programs for cockpit personnel, originally known as *cockpit resource management*, which focused on flight personnel in cockpit simulators.<sup>12</sup> These programs subsequently expanded to include the entire flight crew, maintenance crews, and air traffic controllers, and became known as *CRM*.

The CRM model focuses on the safety, efficiency, and morale of humans working together. Although no definitive study has correlated CRM training with enhanced airline flight safety, the aviation industry accepts this practice at face value, and CRM training is an international requirement for all aviation employees.<sup>13,14</sup> CRM has moved aviation training beyond the limited focus of technical flying to broader dimensions of human factors engineering, fatigue and stress management, effective communication, shared awareness, and teamwork. In surveys, airline crew members consistently cite CRM training as relevant, useful, and effective in changing attitudes and behaviors to improve safety.<sup>15</sup>

### CRM in Health Care

Cross-sectional surveys have suggested that safety-related behaviors applied and studied extensively in aviation may also be relevant in health care.<sup>15</sup> Helmreich and Merritt have proposed a translation of teamwork behaviors from aviation to health care by the application of “countermeasures”—briefings, debriefings, standardized communication language and process, workload distribution, fatigue management, inquiry, graded assertiveness, contingency planning, and conflict resolution—introduced in CRM training.<sup>16</sup> CRM applications in a simulated work environment have been applied in ORs, labor and delivery units for neonatal resuscitation, and hospital emergency

departments (EDs).<sup>2,17-19</sup> CRM training has been undertaken for multiple medical disciplines in large health systems.<sup>20,21</sup>

### CRM Program in the VA: Medical Team Training

A strong case can be made for implementing a CRM program in the Department of Veteran Affairs (VA). In approximately 75% of more than 7,000 root cause analysis cases reported to the National Center for Patient Safety (NCPS) database, communication failure was identified as at least one of the root cause, contributing factors.<sup>22</sup> Data from the National Veterans Affairs Surgical Risk Study show lower than expected morbidity and mortality when surgical services had effective interdisciplinary peer interaction.<sup>23</sup> Also, in a survey of 125 VA medical centers (VAMCs), Meterko and colleagues reported a strong correlation between teamwork culture across professional disciplines and patient satisfaction.<sup>24</sup>

The Medical Team Training (MTT) program is based on CRM principles from aviation. Unique to this program is a learning session hosted in each VAMC, which is facilitated by two clinician peer faculty members who present the program in a health care context. For each learning session, the two MTT faculty members are selected for clinical domain expertise matched to participating clinicians in each VAMC.

### MTT Learning Session: Peer-to-Peer Communication in a Health Care Context

MTT faculty members are selected for their clinical background and expertise. We believe that the messenger for change is important because Rogers identified peer-to-peer communication as critical to the success of advocating for change.<sup>25</sup> Accordingly, MTT learning sessions are facilitated by two faculty members, a physician, and a nurse, who work together as a model for collaborative teamwork. (Current MTT faculty members are as follows: 6 nurses [including J.N.], 3 surgeons (2 cardiac [E.J.D., M.D.C.] and 1 general/oncology), 1 obstetrician-gynecologist and VA quality scholar, and 1 clinical psychologist [P.D.M.]. One MTT staff member has a master's degree in communication [A.L.C.]).

Because heavy emphasis on aviation in CRM training

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could impede health care professionals' willingness to apply the principles to the clinical workplace,<sup>26</sup> curriculum content in MTT learning sessions is focused entirely on health care.

The MTT model is designed to test two hypotheses:

1. Improve patient outcomes
2. Enhance job satisfaction among health care professionals

We plan to test these hypotheses with a rigorous program evaluation after deployment of the MTT program throughout the VA health system.

In Fall 2003, 6 pilot facilities enrolled in the MTT program. From September 2004 to January 2007, 22 additional facilities voluntarily enrolled. This report describes the conceptual model and implementation of the MTT program for the 43 enrolled VAMCs (of a total of 163) that have hosted 55 learning sessions, representing more than 4,000 professionals, as of May 1, 2007 (the program's national rollout began in January 2007). All 6 of the original pilot facilities will be included in the rollout because of the significant changes in the program that have occurred in the interim.

### **The Four Components of MTT**

The MTT program is composed of the following four components:

1. Application, preparation, and planning
2. Interactive learning session hosted by the participating VAMC
3. Implementation of MTT project and follow-up with NCPS faculty
4. MTT program evaluation

#### **1. APPLICATION, PREPARATION, AND PLANNING**

The MTT program has been available to VA facilities on a voluntary basis from September 2003 to January 2007, when it became required for all facilities providing surgical services. The 43 facilities that have enrolled in the program involve clinical units such as the OR, postanesthesia care unit, intensive care unit, emergency department (ED), ambulatory clinics, and long term care. Personnel for other units and senior administrators frequently attend the sessions.

The VAMC submits the program application, available on the NCPS intranet. As specified in the application, the

VAMC's commitment entails the formation of an interdisciplinary implementation team, which selects its MTT project from a menu of options (Table 1, page 320). Each team is composed of physicians, nurses, allied health professionals, and administrators relevant to the targeted clinical group, such as surgical services and the surgical ICU.

Preparation and planning begins three months before the scheduled learning session, with a conference call between the MTT administrator and facility senior leadership. For surgical services, the OR must be closed to elective procedures on the day of the session. A second session will be offered to additional staff, provided an interdisciplinary group of at least 30 individuals is registered in advance.

NCPS faculty conduct conference calls with the facility's implementation team at intervals of two months, six weeks, and two weeks before the scheduled learning session. The focus of these calls is on team organization and the selection of the MTT project options.

#### **2. LEARNING SESSION**

Each learning session is hosted by the participating VAMC for a full day of interactive dialogue using CRM techniques (Table 2, page 322) between faculty and participants. Rules of Conduct, which are basic compartment rules for interaction in the workplace, are also presented (Table 3, page 323). Teaching films of clinical vignettes demonstrate CRM applications to health care (Table 4, page 323). NCPS faculty for each session is composed of a physician, a nurse, and a facilitator with communication expertise.

During program development in 2004, nine teaching films were written and produced by MTT faculty in collaboration with the Simulation Center of the Palo Alto, CA, VAMC (Table 4). These films are shown throughout the learning session to model examples of CRM applications in health care. In January 2007, nine additional teaching films demonstrating standardized patient hand-offs were produced by NCPS in collaboration with the Boston VA Health Care System; these films (Table 5, page 323) were also integrated into the sessions.

Following the conclusion of the learning session, the implementation team meets with NCPS faculty to finalize its options for its MTT project. Each VAMC participating in the MTT program makes a commitment to begin

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**Table 1. Medical Team Training (MTT) Project Options\***

MTT Project Option	Application	Example Unit/Service	Example Frequency
1. Preoperative Briefings & Postoperative Debriefings in the OR <sup>†</sup>	Brief preop meeting in the OR suite guided by checklist with all surgical team members present. Debriefing is held at the conclusion of the procedure before patient leaves room.	General surgery	% of general surgery (or single surgeon) cases with briefing and debriefing
2. Interdisciplinary Patient-Centered Briefings (Rounds)	Professionals from different disciplines meet at the patient's bedside for establishing or updating the plan of care. Patient and family member are included.	Surgical ICU	One or two days per week
3. Interdisciplinary Administrative Briefings	Professionals from different disciplines meet for managing resources and problem solving in clinical units.	OR nursing, surgical services, and SPD meet to anticipate needs of surgical procedures in the following week.	Weekly
4. Standardized Patient Hand-offs	Implement standardized patient hand-offs guided by a checklist template (e.g., SBAR).	1. RN-to-RN change of shift 2. RN-to-MD change in patient condition 3. RN-to-RN patient transfer from OR to ICU, OR to PACU 4. MD-to-MD on call/patient transfer	Variable
5. Code Team Members Debriefing Code Events	Code Team members meet to discuss code event for purpose of learning and quality improvement.	Debriefing within 24 hours of code event	% of code events with debriefing
6. VA Strategic Nap Program <sup>‡</sup>	Implement strategic napping under controlled VA study.	ICU nursing staff employing strategic napping during break periods	Variable

\* OR, operating room; ICU, intensive care unit; PACU, postanesthesia care unit; SPD, supply procurement distribution; SBAR, Situation–Background–Assessment–Recommendation; RN, registered nurse; MD, physician; VA, Department of Veterans Affairs.

<sup>†</sup> Required for surgical services.

<sup>‡</sup> Smith-Coggins R., et al.: Improving alertness and performance in emergency department physicians and nurses: the use of planned naps. *Ann Emerg Med* 48:596–604, Nov. 2006. Epub May 2, 2006.

implementing its project within days of the learning session and to sustain the project for at least one year.

### 3. MTT PROJECT IMPLEMENTATION AND FOLLOW-UP

Of the menu of MTT activities (Table 1), option 1 (preoperative briefings and postoperative debriefings in the OR) is required for all participating surgical services. Most facilities choose at least one additional option for

their project, although the selection of more than two additional options is discouraged.

The facility's implementation team undergoes semi-structured interviews by the NCPS evaluation team at one month and then quarterly for one year. These interviews provide qualitative data on the VAMCs' experiences with MTT project implementation. In addition, all VAMC participants can communicate with NCPS staff and other facilities in group monthly conference calls and on an

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e-mail listserve to facilitate collaboration between facilities.

In the morning of the learning session, each attendee completes the Safety Attitudes Questionnaire (SAQ),<sup>27</sup> which takes approximately 10 to 15 minutes. The questionnaire measures six relevant factors—teamwork climate, safety climate, job satisfaction, working conditions, perceptions of management and stress recognition.

### 4. MTT PROGRAM EVALUATION

We are employing a multilevel evaluation, as adopted from Kirkpatrick<sup>28</sup> and recommended by Salas et al.,<sup>29</sup> as follows:

1. **Reaction.** Did they like it? We are using data from a VA Employment Education Service (EES) survey, administered at the end of the day, to assess attendees' reactions to the learning session.
2. **Learning.** What did they learn? We are using the SAQ before and one year after the session to assess learning.
3. **Behavior.** Did their behavior change? We are collecting qualitative data from quarterly semistructured interviews for one year to assess behavioral change.
4. **Organizational Impact.** Was there an impact on measurable safety outcomes? We are collecting data from the VA All Employee Survey Job Satisfaction Index, surgical outcome data, and VA quality performance data for a "within group" and "between group" comparative outcome analysis.

The MTT learning session is sponsored by the Employee Education Service (EES) of the Veterans Health Administration (VHA), which provides certified educational credits for attending staff. (These data have demonstrated that 80% to 90% of participants from 55 learning sessions were satisfied with the MTT program, which also met their educational objectives.)

### VHA Experience with Medical Team Training

Sidebar 1 (page 324) reports the Boston VA Health System's experience with the MTT program.

### Discussion

Lessons learned from our early experience with the MTT program will inform its continuing evolution. We have found that support from administrative and clinical lead-

ership, such as the facility director, chief of staff, nurse executive, and chief of surgery, are vital to achieving "critical mass" of staff attendance for the learning session. For surgical groups, the chiefs of surgery and anesthesiology, as well as the OR nurse manager, must be active members of the implementation team.

To reach a significant number of professionals from the ICU and other units targeted by leadership, sessions on two consecutive days can be offered (given the minimum attendance of 30 interdisciplinary professionals). The sessions are interactive, with a focus on barriers to communication across professional boundaries. When attendance falls below 30, the session begins to lose its value in terms of a rich interactive dialogue. Content for learning sessions must focus on clinical examples of CRM rather than on aviation examples. The translation of CRM relevance from aviation to health care is an important task for faculty and should not be assumed for clinicians.

A standardized and comprehensive approach to a facility's preparation for the learning session and planning for the MTT project are keys to successful program implementation. Learning sessions are more likely to resonate with participants if facilitated by clinical faculty with background and expertise matched to the clinicians attending. For example, an OR and ICU group would be assigned clinical faculty such as a surgeon or an anesthesiologist paired with an OR nurse or ICU nurse.

The lessons learned from our experience with 43 VAMCs have led to the following modifications of the program:

- Program applications are structured to initiate a discussion between the MTT program administrator and facility leadership (for example, facility director, chief of surgery, chief of staff) to ensure a serious commitment to meeting program requirements before scheduling the learning session(s).
- Preparation and planning for the learning session requires a minimum of 2 months.
- Follow-up and data collection for a minimum of 12 months following the learning session is required.
- Implementation teams must be representative of the relevant workforce and must include a representative from the facility director's office.
- All facilities must initiate projects within one to two weeks following the learning session to enhance likelihood

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of program implementation.

- Starting small in scope and scale will increase the probability for successful program implementation.

Participating surgical teams implementing briefings and debriefings in the OR have reported improvements in communication and the quality of care. Several of the participating facilities reported efficiency gains from streamlining instrument packs (for example, by eliminating unused instruments). Circulating nurses have reported that as a result of the proactive administrative briefings between nursing, surgical services, and the supply procurement distribution departments, they spend less time “running around” looking for instruments. Several facilities

have reported that briefings and debriefings in the OR enabled them to avert potential adverse events such as a wrong-site procedure or wrong procedure. Others have cited proactive fatigue management on surgical teams, fewer “waiting time events” during procedures, improved job satisfaction and morale among nurses, active surgical resident participation in briefings and debriefings, and the prevention of potential harm to several patients as a result of what was learned in a preoperative briefing.

For example, the Houston VAMC surgical services hosted their learning session in September 2004. In a report on their one-year experience with the MTT program, they cited measurable improvement in communica-

**Table 2. Crew Resource Management (CRM) Communication Principles, Tools, and Techniques\***

CRM Tool	Communication Principle/Method
Rules of Conduct	Ground rules for communication that focus on mutual respect and shared responsibility
SBAR	Situation–Background–Assessment–Recommendation: a structured framework for reporting patient information for hand-off in care responsibility (holistic approach with bottom line recommendations)
Graded Assertiveness	Method for increasing levels of assertiveness in the normal course of work to optimize patient care especially relevant for an individual facing an authority gradient (e.g., nurse addressing a physician)
Two Attempt Rule	Method for escalating assertiveness prior to ascending chain of command
Feel the Pinch	Intuitive sense that something is wrong
Call Out	“Speaking up” to team members when completing a task, making an important observation, or when something appears to be wrong
Step Back	Method for stopping a process or procedure to reflect on the course of events, reassess prior assumptions, and question the efficacy of the action plan (e.g., “Stop what you are doing and listen to my concern.”)
Repeat Back	Method of repeating a verbal order or information to confirm mutual understanding (e.g., nurse repeating an order by a physician in the OR, ER, or Med-Surg unit)
Read Back	Method of transcribing a verbal order or information and reading it back to confirm mutual understanding (e.g., nurse reading back telephone order from a physician)
Dynamic Skepticism	Attitude of questioning the validity of previous assumptions by constantly evaluating incoming data—accept only what you see and know
Situational Awareness	Understanding of current status with impact on activity goals in a dynamic and changing environment
Work Load Distribution	Balanced distribution of work among all team members to achieve an optimal outcome
Fatigue Management	Acknowledging the effect of fatigue on human performance by developing strategies for fatigue management to optimize the safety of patients and staff

\* OR, operating room; ER, emergency room.

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tion between anesthesiologists and surgeons as a result of preoperative briefings and postoperative debriefings,<sup>30</sup> as well as improved performance with respect to administration of prophylactic antibiotics, prophylaxis for deep vein thrombosis, and medical record documentation.

Too often, new practices are introduced to clinicians without adequate implementation strategies and mentoring. We emphasize testing the adoption of team practices on a very small scale, with one team working in a clinical unit and with modifications to fit the local environment before any attempt at implementation on a larger scale. On a surgical service, preoperative briefings and postoperative debriefings should at first be limited to one or two surgical services. After successful implementation and consistent practice demonstrate a benefit to participants and patients, growing staff acceptance should lead to gradual dissemination among other surgical services. We have observed this phenomenon in the majority of our participating facilities.

Participating facilities have been encouraged to quantify their improvements and to estimate their avoidance of adverse events. Such "undesirable events" in surgical patients may include untimely or failed preoperative antibiotic administration, failure to provide necessary surgical instruments, failure to provide necessary blood products in a timely fashion, inappropriate or absent surgical consent documents, inadequate preoperative evaluations, surgical wound infections, postoperative deep vein thrombosis, postoperative pneumonia, and other comorbid events.

### Report Limitations

Many of the implementation teams are instituting multiple interventions (options) as part of the MTT program, making it difficult to determine each intervention's relative effectiveness. We have developed a standardized instrument for data collection during the quarterly semistructured interviews that should provide more detailed information about the impact of the interventions. We anticipate that measurable differences in outcome measures for the participating facilities will not be demonstrated at the individual facility level.

### Conclusion

Despite the limitations of this report, we have demonstrated the feasibility of developing and implementing a

**Table 3. Rules of Conduct**

Respect each person  
Share responsibility  
Criticize only ideas not people  
Keep an open mind  
Question and participate  
Attend all meetings on time  
Listen constructively

**Table 4. Medical Team Training Films (2004)\***

1. Interdisciplinary Patient Centered Rounds in the ICU
2. Interdisciplinary Administrative Briefing in the ICU
3. Preoperative Briefing in the OR Suite
4. Cardiac Surgery Procedure in the OR
5. Post-op Debriefing in the OR Suite
6. Clinical Case on Internal Medicine Service—Ineffective Communication
7. Clinical Case on Internal Medicine Service—Effective Communication
8. Code Resuscitation
9. Debriefing of Code Resuscitation by Code Team Members

\* ICU, intensive care unit; OR, operating room

**Table 5. SBAR Patient Hand-Off Films (2007)\***

1. Patient Hand-Off from OR-to-ICU
2. RN-to-RN Change of Shift in the ICU
3. MD-to-MD Hand Off for Weekend on Call
4. RN-to-RN Hand Off for Change of Shift on Surgical Unit
5. MD-to-MD Resident Sign-Out on Internal Medicine Service
6. MD-to-MD Patient Transfer from Inpatient to Outpatient
7. RN-to-MD Report of Change in Patient Condition
8. RN-to-RN Patient Admission from ED to Medical Unit
9. RN-to-Rapid Response Team Hand Off on Medical Unit

\* ICU, intensive care unit; OR, operating room; ED, emergency department

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### Sidebar 1. Report of an MTT Experience at the Boston VA Health System

In November 2003, the chief of surgery for the Boston VA Health System (which consists of two campuses—West Roxbury and Jamaica Plain) canceled the elective surgical schedule in the West Roxbury facility to facilitate the OR staff attendance of the MTT learning session there. At the beginning of the program, an MTT questionnaire was administered to attendees for an assessment of attitudes and behaviors about collaboration and teamwork in the workplace.

Immediately after the learning session, a smaller multidisciplinary group of surgical staff met to design a strategy for implementing preoperative briefings in the OR suites. In such a briefing, following surgical-site verification and a "time-out," the surgeon details the usual and unusual aspects of that planned procedure. The anesthesiologist, OR nurses, and OR technicians assigned to that case and any other personnel (for example, vendors with special instrumentation) have the opportunity to ask questions and clarify any procedural or safety issues before the skin incision. Pertinent details are listed on the whiteboard and/or briefing card to enable consistent transmission of information in the event of shift changes, scheduled staff breaks, or a change in personnel.

Surgical specialists from orthopedics, general surgery, and cardiac surgery committed to performing preoperative briefings before their respective surgical cases. These briefings were conducted in the OR suite before induction of general anesthesia. The briefing process was facilitated through the use of briefing cards and whiteboards in each OR suite. The initial experiences with preoperative briefings were reviewed locally by the multidisciplinary group and with the MTT faculty via a series of conference calls and e-mail exchanges.

At the conclusion of each surgical procedure, a debriefing

of the entire OR team was held in the OR suite to review its experience, assign tasks, if necessary, and to solicit suggestions for process improvement. Each suggestion was logged into a spreadsheet and collated into specialty-, procedure-, or provider-specific categories by the surgical service's clinical coordinator. Safety issues or recurring problems identified by the debriefings were addressed with the appropriate personnel.

On the basis of feedback from the debriefing data, the following quality improvement changes in OR processes were implemented:

1. A consult form for OR booking was developed, which was added to the electronic OR scheduling database.
2. Members of the OR nursing staff established a subspecialty case scheduling meeting to clarify staffing and instrument needs.
3. Instrument sets were modified and streamlined to enhance their utility for the respective surgical teams.

Lessons learned from the Boston VA Health System were as follows:

1. Preoperative briefings cannot resolve administrative issues, such as special equipment or staffing needs, that require substantial advanced planning, but briefings can raise awareness about such deficiencies, which can be corrected for future cases.
2. Preoperative briefings should be concise, include all members of the surgical team, and be customized to fit the organizational culture.
3. Briefings can highlight communication barriers between disciplines.
4. Facility senior leadership support is critical to the success of the MTT project.

CRM program in a large integrated health system. We plan to test our hypotheses for program-associated improvement of surgical outcomes and job satisfaction with aggregate data analysis after the program's rollout to the entire VHA. **J**

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